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# Technology Tools for Improving Online Learning Environments

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# Technology Tools for Improving Online Learning Environments

**by**

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**Report**

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# Abstract

## Technology Tools for Improving Online Learning Environments

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I worked on technical Web applications for two different research groups for my master's project. The first application was Adventure Learning Water Expeditions, an online learning environment for K-12 students in Idaho. The second was Project Engage, a computer science principles course for high school students. In this paper, I describe each Web application by going over the technical details of the application, describing the challenges I faced, and connecting my work with relevant research in the field of Learning Technologies.

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# Chapter 1: Introduction

I worked on technical Web applications for two different research groups for my master's project. The first application was Adventure Learning Water Expeditions, an online learning environment for K-12 students in Idaho. The second was Project Engage, a computer science principles course for high school students. In this paper, I describe each Web application by going over the technical details of the application, describing the challenges I faced, and connecting my work with relevant research in the field of Learning Technologies.

Before starting this project, I had worked on Web development projects in another research group. In those projects, I learned how to use PHP and MySQL to create and manage information in a database. For my master's project I was able to further develop my previous skills and use them to develop educational materials that were more student-centered.

# Chapter 2: The Experiment/Inquiry Database

## Project Description

The Adventure Learning Water Expeditions is an online learning environment for K-12 students in Idaho. Students explore and collect data on water supply problems and share their results on the Adventure Learning (AL) website. The project had a need for an online space in which students could enter their experiments and results and see the results of their peers. I created a form (figure 1) in which the students could select a category and subcategory for their projects and then enter their questions, experiment plans, and results. The final project is available at http://adventurelearningat.com/inquiry-projects/ and http://adventurelearningat.com/inquiry-projects-retrieval/.

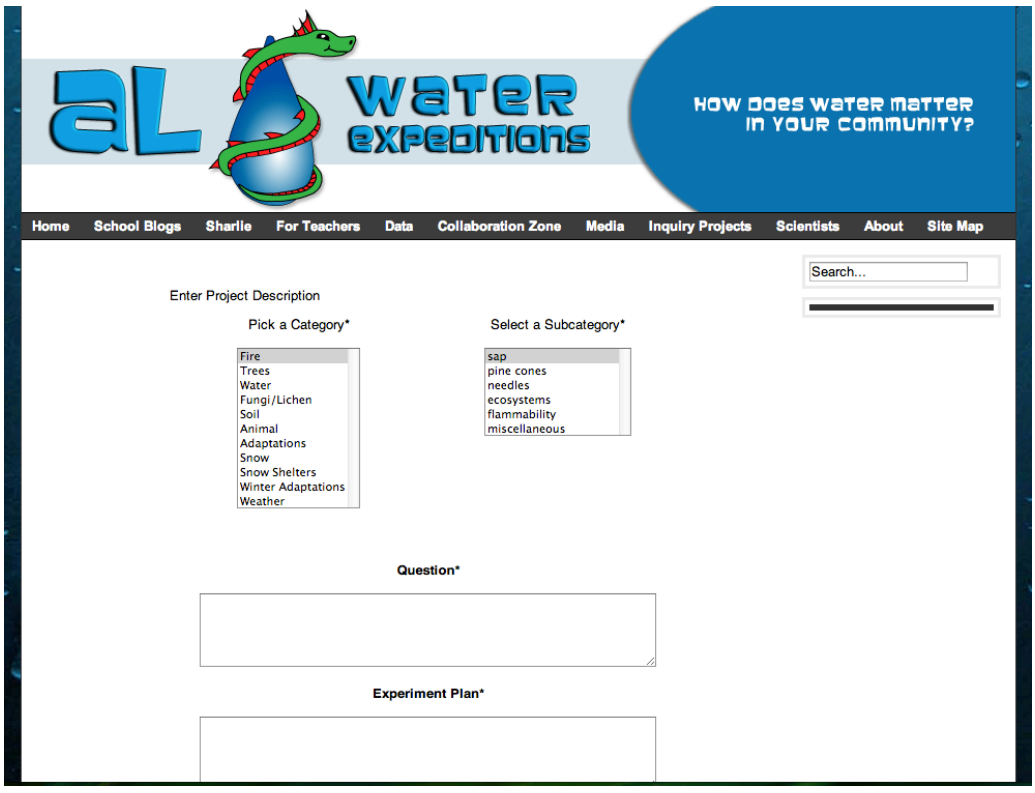


Figure 1: Inquiry projects application

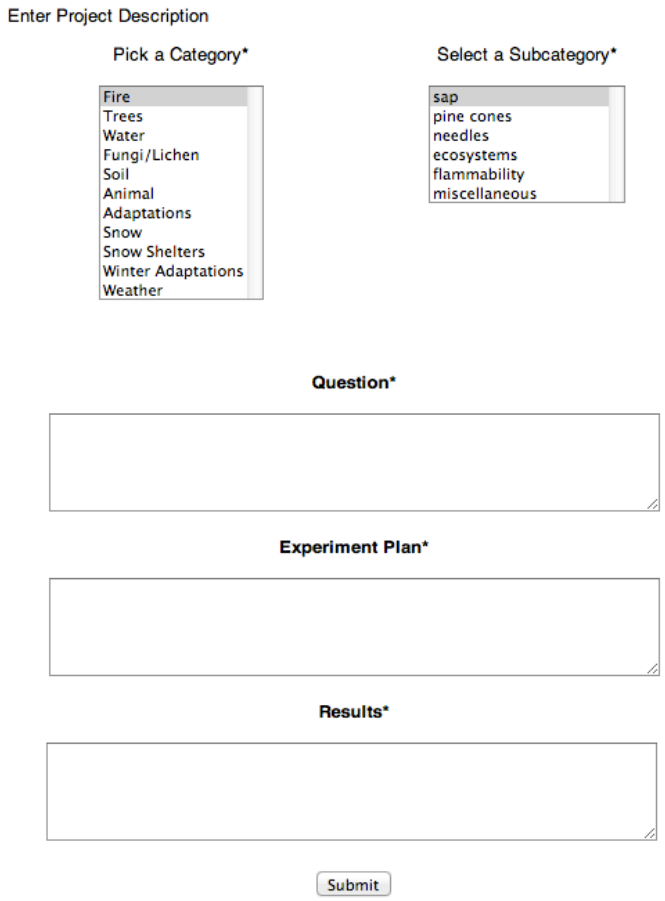


Figure 2. Close up picture of the inquiry form

The form also checks for an array of inappropriate words and phrases (e.g. sexual references) before a student is able to submit his or her entry. The student must enter a response in each text area before he or she is able to submit the form.

Once a student submits the form (Figure 2), he or she is able to go the data retrieval page (see Figure 3) and see what his or her peers' experiments were in the same category (see Figure 4). Students can search prior submissions by using the same categories and subcategories.

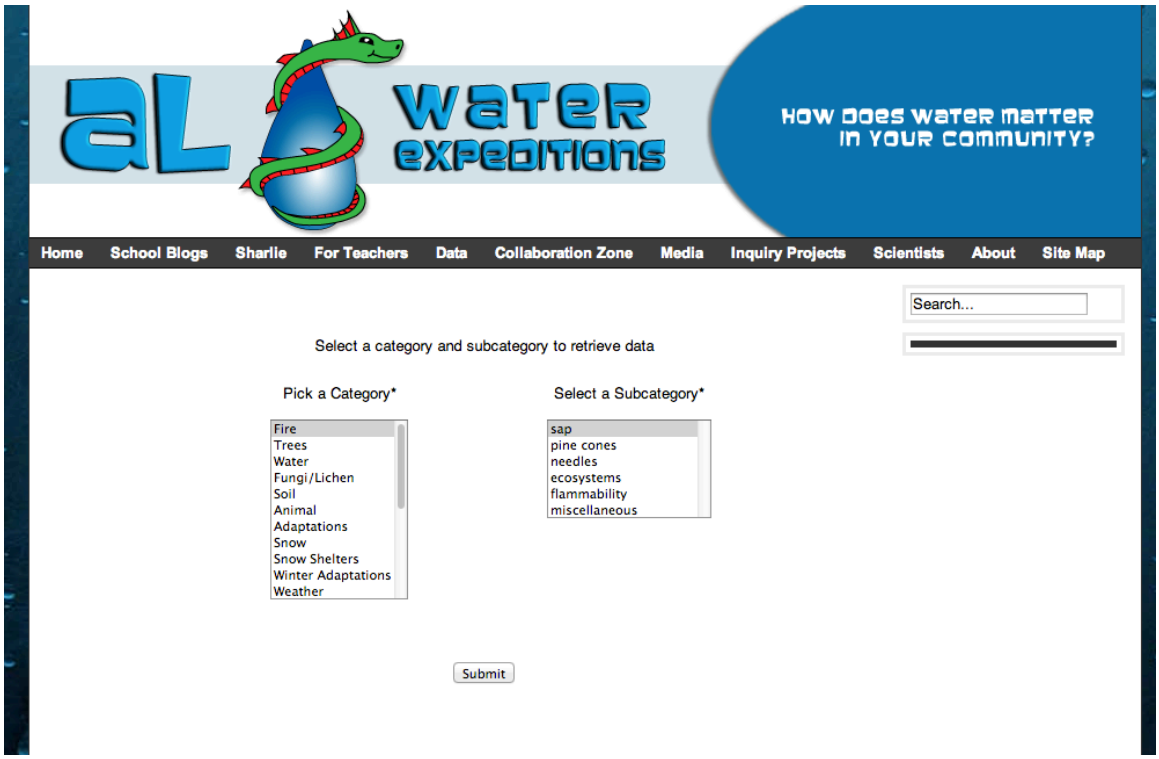


Figure 3. Picture of the data retrieval page

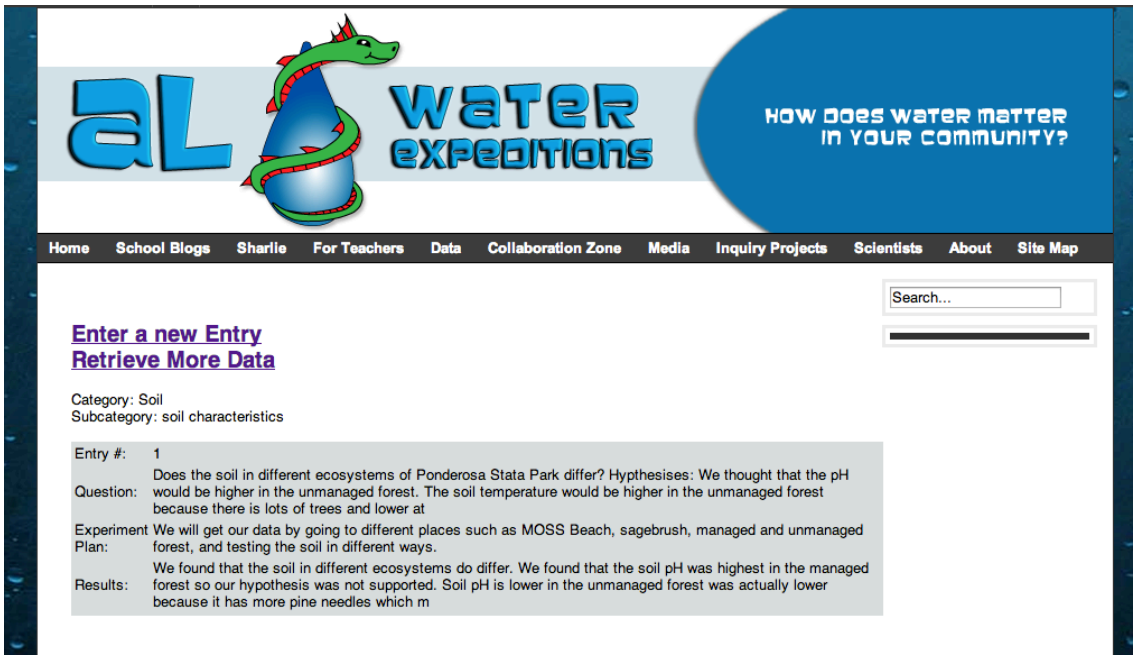


Figure 4: Picture retrieval results page

**Technical Details**

I created both pages using HTML, PHP, MySQL, and JavaScript. I created an HTML form that called on a PHP script to save the information to the MySQL database. Before the information is saved, a JavaScript file is called to check the entries for inappropriate words and to see if every text area has been filled. If an inappropriate word is found, the user gets an alert saying to change that text area before being able to submit. The entries are easily viewed in phpMyAdmin (see Appendix A) and can be deleted by the administrator if the JavaScript file does not catch an inappropriate word.

**Challenges**

The pages are created to live in the existing Adventure Learning WordPress website, so they were designed to display well inside an HTML iframe tag. The pages needed to be resized constantly so no scroll bar would show, and it was not obvious that the page was different than the others.

I normally save text inside a database using 255 characters, but I found that student entries utilized many more characters. I increased the varchar (variable character field) to 900 characters. The form has not been used much by students yet, but once I have an average entry length size, I will adjust the variable accordingly.

Checking for inappropriate words in an entry was actually a more difficult task than originally anticipated. There are two ways a programmer can implement inappropriate word search: First, to search for the inappropriate word character by character, but then an innocuous word like “bass” or “assets” can be flagged; or second, to search for inappropriate words by checking each individual word, but then each

variation of each inappropriate word must be checked against the list of inappropriate words. Searching character by character would restrict the student's responses more by flagging non-inappropriate words. In order to restrict the student less, I chose the latter approach and used a list of over 200 inappropriate words. Entries with inappropriate words can still be submitted because of the limited number of words it checks so the administrator can go into phpMyAdmin and delete the entry individually if necessary.

**Reflection**

This project was straightforward and was an easy transition into making a Web application. The programming challenges were small and easy to overcome. I enjoyed going through the process of figuring out the best way to save the information in order to most efficiently query the database and the thought process of figuring out the best way to filter inappropriate words.

In the future, I would like the opportunity to add a feature that allows students to comment on each of the entries in each category and subcategory. Students would then be able to ask other students why they did an experiment a particular way or comment on the results. This would allow other students to think critically about their experiments and be able to justify their reasons behind their experiments to their peers.

**Connection to Learning Technologies**

For this project I focused on implementing three of the principles outlined in the Adventure Learning Principles (Doering, Miller & Veletsianos, 2008).

- *a researched curriculum grounded in inquiry;*
- *collaboration and interaction opportunities between students, experts, peers, and content;*
- *utilization of the Internet for curriculum and learning environment delivery;*

The project centered on entering information completed through an inquiry-driven experiment. Through my work, I provided an online place for students to enter and retrieve their information and information from their fellow students.

On the scale of technology-supported-pedagogy (Hughes, 2005), this project is just a replacement. The technology of having an online database only replaces manual input of data. There is a little amplification because others are able to see the data immediately after submission, but in my opinion, there is not enough to warrant the project's inclusion in the amplification category. Instead of spending time compiling all student experiments, the teacher can spend more time on instruction and ask the students to think critically about their peer's experiments in the each category. The database contains all the previous experiments from the different schools in the Adventure Learning program so students can look at past work and see if they want to expand or change some of their experiment variables.

It was very important in both the inquiry database and the submission form to be consistent. Originally, the inquiry database used a dropdown menu for the category and subcategory while the submission form had all choices visible at all times. This caused

confusion among our users who expected the same interface for both. This feedback was provided by the students to the head of the research group. Mathis (2011) states that if "things that do look similar need to do exactly the same thing in exactly the same way, since people will try to apply their existing mental models to it." The feedback by students reiterates why putting the product in front of the users, even in informal usability feedback, is so important.

## Chapter 3: How is water important in your community?

### Project Description

In a previous project in my Adventure Learning class, I created a Google map that would find the students' locations through their browsers and ask them to record the math they did at those particular locations. The maps had the students input their names, the names of their current locations, and the math they were conducting there. Then, on a second map below the first, the students could see all the entries (map pins) students had entered in the Austin area.

For the Adventure Learning Water Expedition project, I created a similar map where students are able to input how water was important in their communities. The final project can be seen at http://adventurelearningat.com/collaboration-zone/.

The original project I created had two maps. This time I was tasked with having the entry process (see Figure 5 and 6) and entries (see Figure 7) on the same map. There were too many technical difficulties and inconsistencies to put the map on one page, which I will explain in detail in the challenges section. Instead, the webpage opens up on the current entries page. Then the user clicks on a button to add an entry and a new webpage with that map displayed.

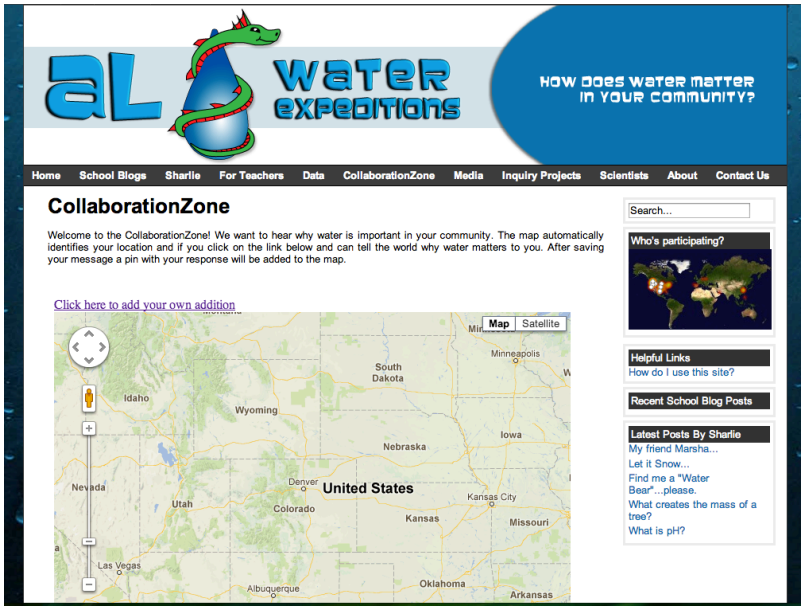


Figure 5: Picture of Collaboration Zone map

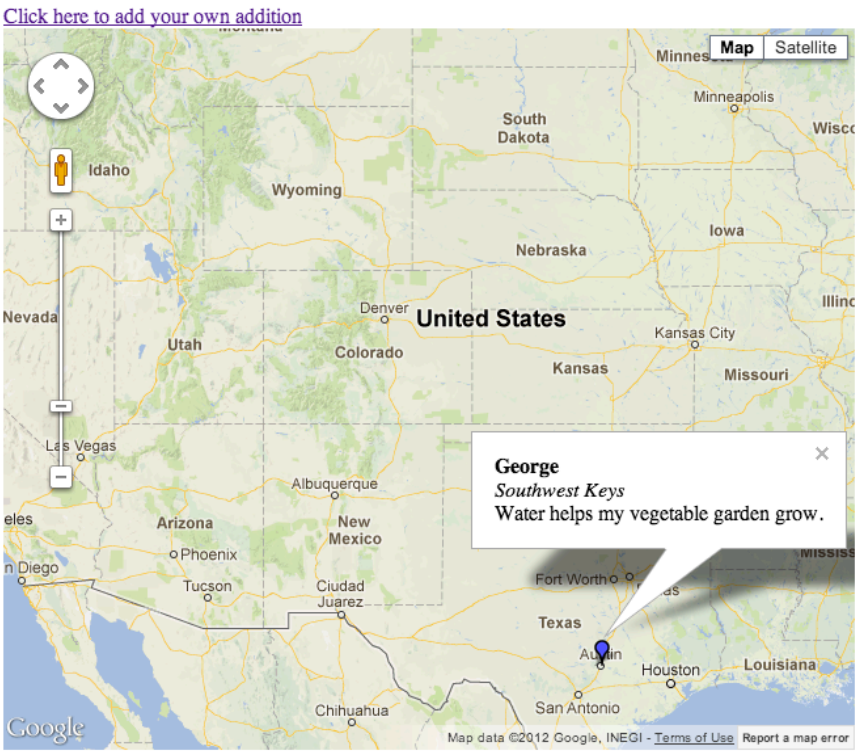


Figure 6: Close up of Collaboration Zone map with an open entry

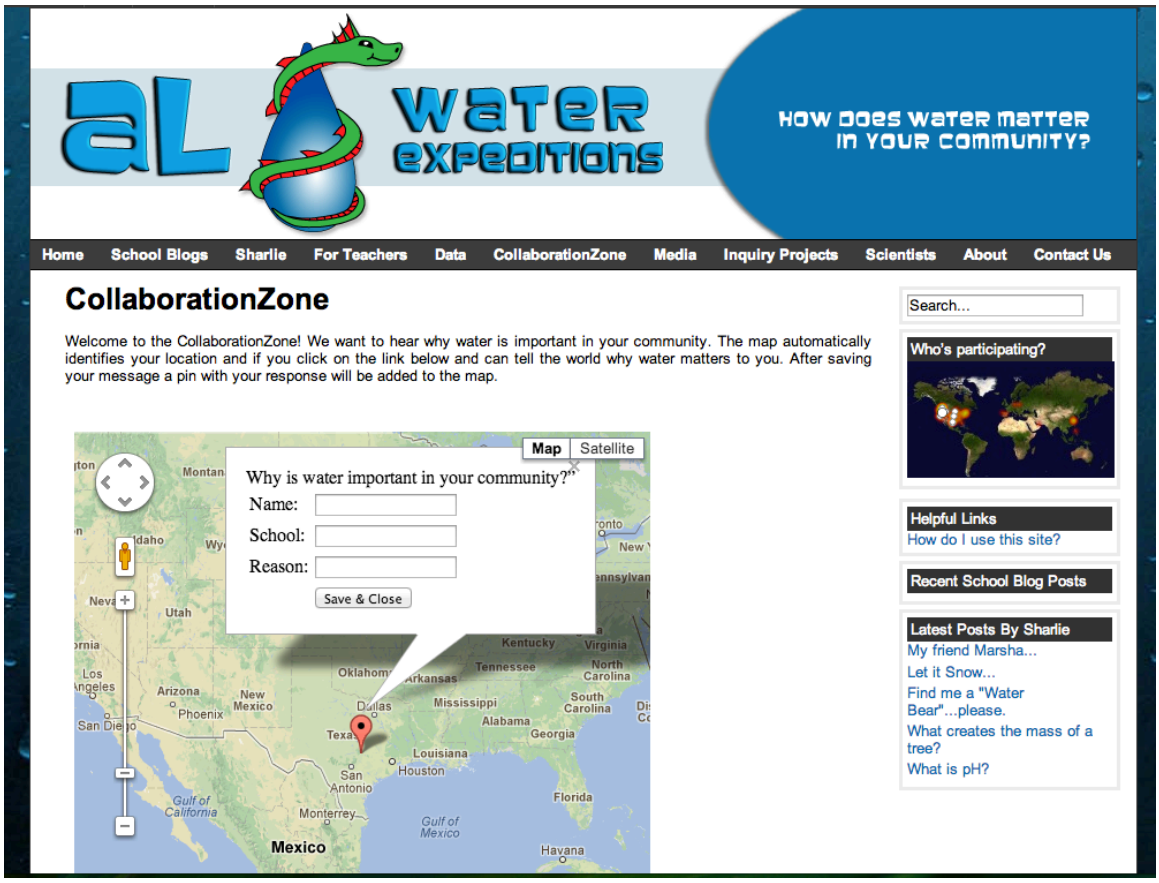


Figure 7: Picture of Collaboration Zone map of your current location and questions

**Technical Details**

I created the entries map using HTML, PHP, MySQL, XML and Google Maps API JavaScript version 3. Entries are saved in a MySQL table. In order to read the table, a PHP script must run that outputs the MySQL table to an XML document. Then, the JavaScript code parses through the XML document and creates a Google Maps marker for each entry in the table and then displays it on the map.

The entry map (see Figure 7) asks the user's browser for its location and then centers the map on that location. If the user's browser has the location feature disabled or blocked, the map defaults to center around Colorado in order to show Texas and Idaho (states in which the research group resides). If the user wants to change the location where the information is saved, the user must drag the pin to a different location. In Figure 4, the location map is shown. The entry is saved using a PHP script. The administrator can look over the entries in phpMyAdmin.

**Challenges**

Merging both maps into one map proved to be the most difficult challenge I was not able to overcome. After merging all relevant methods into one JavaScript file under the same map identifier, the map did not display any information. After some debugging, I figured out that the problem was in the XML output. The PHP script no longer created an XML document, instead it created HTML code. I could not figure out what was happening so I spent a lot of time researching the issue. The XML document was not being created because the header specifying to create a XML document was not being executed even though it was in the code. I found that the particular header that would tell the PHP script to output an XML document was being executed after headers had been sent. The PHP script contained the same code that worked previously when there were two maps, so it was difficult to figure out where the problem was originating. After trying different variations of existing code, I tried to include the database connection information in the same file as the PHP script that outputted XML. Even though in the

previous working version the scripts were in two separate files, this time they needed to be the same file for the headers to be sent properly.

After the entries displayed correctly on the map, the second issue I ran into was saving the water information into the database. The entry would save the location from the pin, but the other three fields (name, location, water importance) would be saved as a blank entry. I was not able to solve this problem on my own. I posted my code and problem on Stack Overflow, a question-and-answer site for programmers. In three days, another user was able to tell me that for some unknown reason the browser was creating two copies of the map entry and the script was saving the empty copy and not the copy where I had entered text. To fix the problem, I took an array of the document entries elements and explicitly asked for the last element in the array that contained the text.

The last challenge I faced was saving the correct location information after dragging a pin to a different location. If the user dragged his or her pin to a different location other than the one detected by the browser, sometimes the new location was not saved into the database. The error did not always occur and, given the time constraints of the project, I was not able to solve the issue and was forced to keep the original design of two separate maps and move on to the next project.

**Reflection**

The project was particularly challenging and frustrating. The solutions to each of the problems I faced did not seem to come from logical places; they were just work-arounds to the problem and did not address the issue. The problems also seemed to be bugs with the Google Maps API and not with the code I had written. Overall, I am

disappointed that I was not able to combine both maps and save the user from having to go to a different window.

**Connection to Learning Technologies**

For this project I focused on implementing two of the principles outlined in the Adventure Learning Principles (Doering, Miller &Veletsianos, 2008).

> • *collaboration and interaction opportunities between students, experts, peers, and content;*
> • *utilization of the Internet for curriculum and learning environment delivery;*

The map has students interacting with each other's online map information. When the map has more entries, students can zoom into their local area and see what others have entered in that area. Students can see the differences and similarities in water importance in different regions in the United States.

On the scale of technology-supported-pedagogy (Hughes, 2005), this project can be categorized as amplification. Google Maps on its own allows for much more than a regular map could accomplish. In this project, students and teachers from different parts of the world are able to access the map and input their reasons as to why water is important in their communities. The user can zoom in with great detail to where others have submitted their pins. This is much more than a replacement for a typical map. Collaboration with other schools that are part of the Adventure Learning program would be next to impossible on a physical map. The teacher can use this to enhance his or her lessons by showing examples of what other students in different areas think about water and then compare it to what his or her students submit. Students can submit more than

once from different areas in their community and see if there answers are different. Student can then take this data and analyze it for trends.

It was very disappointing to not be able to make the maps into one concise map. It's usually important in usability to keep to a shallow hierarchy (Mathis, 2011) and have users go through fewer mouse clicks. In this case, it was not possible and the technology hurdles were too great.

## Chapter 4: Project Engage Website

### Project Description

Project Engage is a dual enrollment computer science principles course for high school students. The project currently only has a one-page descriptive website. For my last project, I worked on developing a full website (figure 8) from a template that the team had purchased. The final project can be seen at https://dl.dropbox.com/u/3313901/Project%20Engage/index.html.

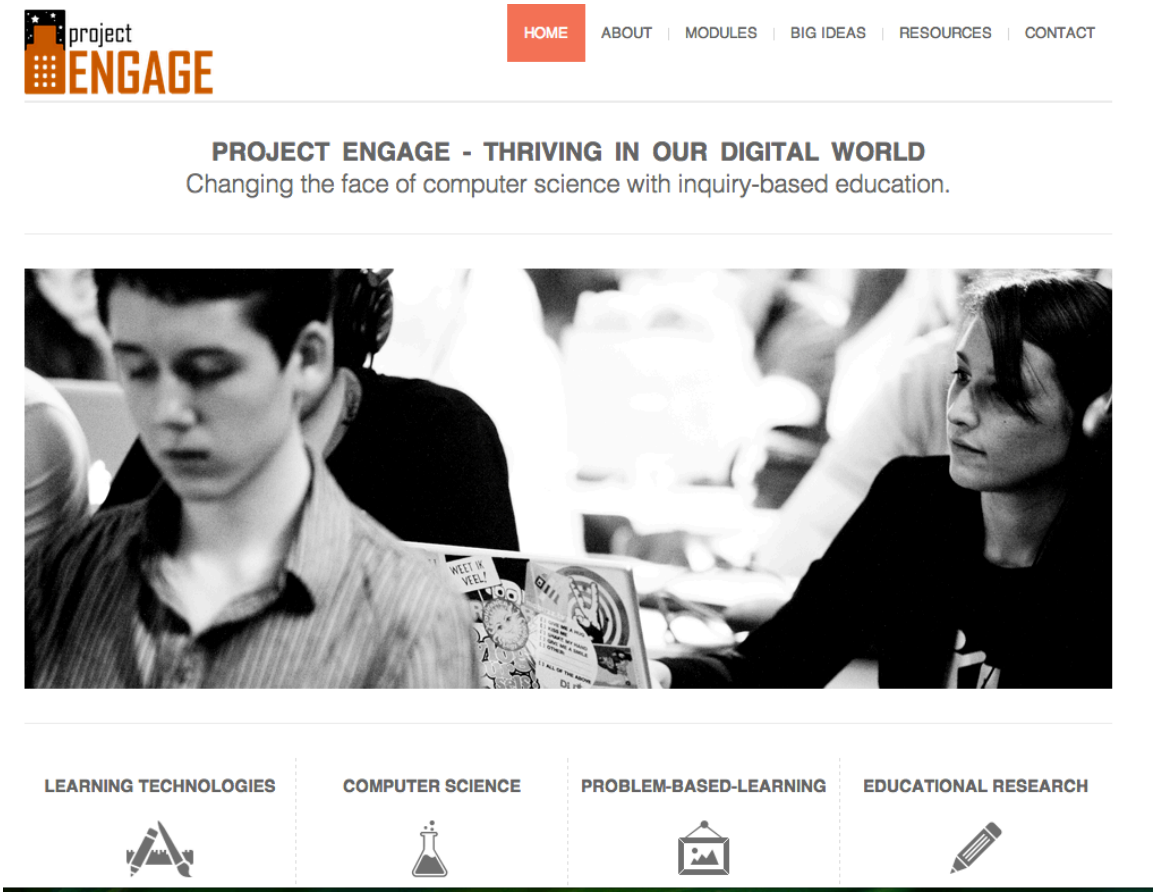


Figure 8: Picture of Project Engage website

**Technical Details**

The template website was created using HTML and CSS and content given to me by the research team. This involved me understanding the code that was already written and being able to figure out where I needed to insert the content from the team. I also had to work with Photoshop to resize and edit all the images given to me from the team.

**Challenges**

All the images provided were of different sizes and I had to edit them to the specification of the template. In some cases, another image was needed in order for it to match the content. Some images were too pixelated or had to be cropped.

The Google Map provided in the template used a different method of displaying a map that I had never used before and seemed only to work when viewing the webpage online. In order to solve the issue in a timely manner, I rewrote the code to use a Google Maps API method that I used previously.

The team did not like some of the text sizing in the modules section of the website. This was the biggest challenge in this project since I did not write the original template. I was careful to make sure I was editing just the text sizing that corresponded to the section and did not change the text on a different page. I had to make duplicate CSS class elements and change their names so I was only changing the correct text.

**Reflection**

This project involved continuous feedback from the team. After each change, the team would accept the change, ask for a different option, or edit the content further. We engaged in significant collaborative discussion, but it did not hinder the project.

**Connection to Learning Technologies**

This project allowed me to use the spiral feedback method (Cennamo & Kalk 2004). I was in constant communication with the group and at each level received feedback and was able to make changes accordingly. As I accomplished a task, I gave feedback and comments on what I had changed. There were at least four iterations of changes between the group and me.

In this case, the instructional designer served as the project manager, and I was the Web developer. As McDaniel and Liu (1994) mention, it is important for the project manager and the developer to be on the same page and use the same terminology. At the beginning there was some confusion as to how I was editing the files because we hadn't established guidelines.

## Chapter 5: Conclusion

The biggest challenge I faced was collecting my notes and organizing my thoughts for this report. Technical projects provide problem-solving challenges that engage me enough not to be distracted by other things online. As Ellen Rose (2010) describes, "continuous partial attention" on the computer is a constant problem for "information junkies" like myself.

Overall, I enjoyed working with both research groups and liked the experience of working on educational technical projects. The adventure learning projects allowed me more of an opportunity to apply some of the education elements I learned from the Learning Technologies program while Project Engage allowed me to use my project management and design skills.

## Appendix A: Using phpMyAdmin

The administrator of the Adventure Learning Water Expedition project needs to know how to use phpMyAdmin in order to screen the entries that are submitted to the inquiry database and the water map.

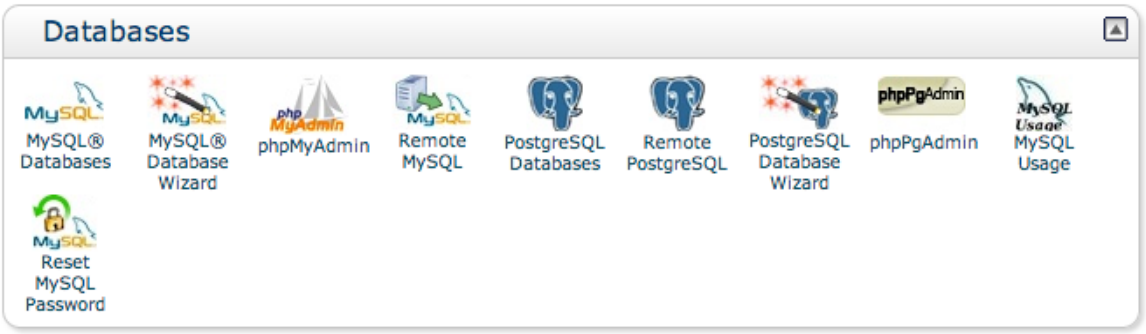


Figure 9: Location of the phpMyAdmin in control panel

Steps to using phpMyAdmin

1. After logging into the control panel on Bluehost, the administer needs to the find the Databases section and click on the phpMyAdmin logo. (Figure 5)
2. Next, the administrator should log in using the username and password that has access to the inquiry database and water map. (Figure 6)
3. On the phpMyAdmin home, the administrator should select the correct database called advenup1_data. (Figure 7)
4. Of the three tables in advenup1_data, the administrator should pick the desired corresponding table. (Figure 8)
5. Table called 'entries' corresponds to the entries in the inquiry database. (Figure 9)

6. Table called ‘markers’ corresponds to the submissions in the water map. (Figure 10)
7. To delete the entry, the administrator should press the red delete icon and to edit the entry, press the yellow edit icon.


Figure 10: Login screen for phpMyAdmin

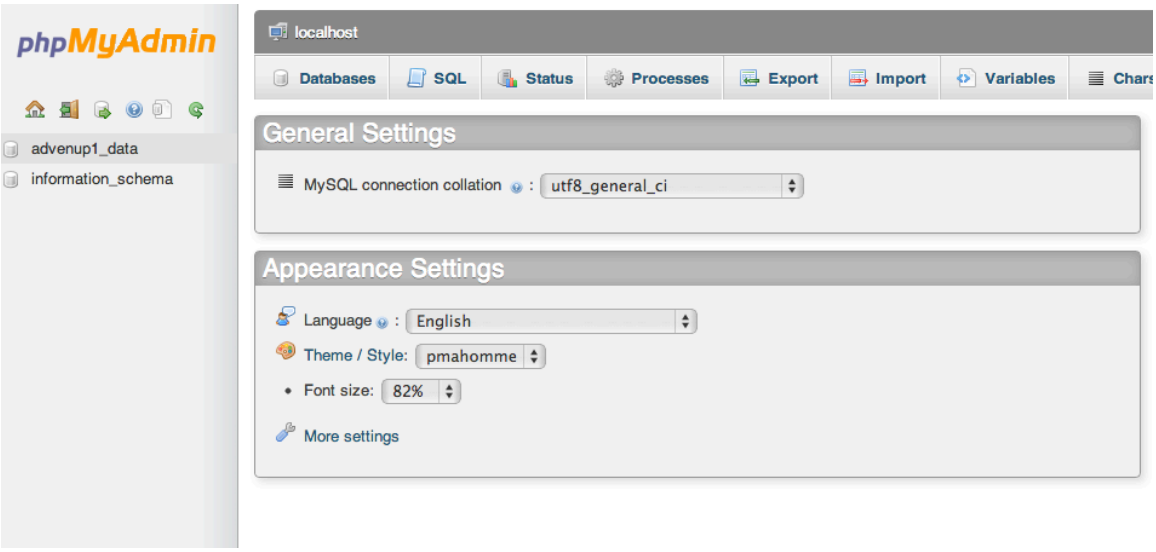


Figure 11: phpMyAdmin home screen

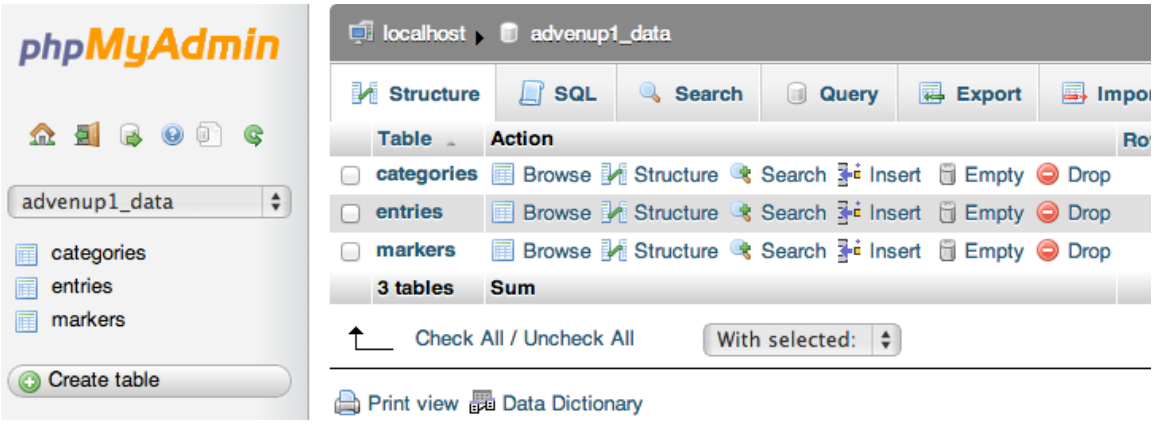


Figure 12: Tables in the advenup1_data database

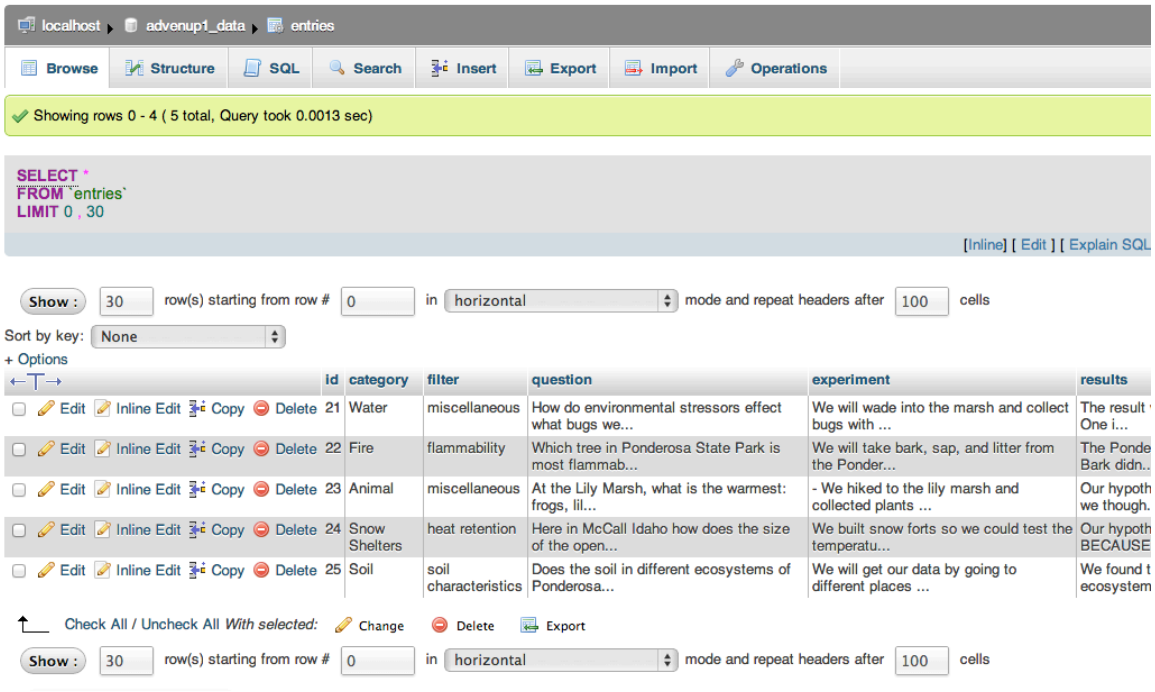


Figure 13: Rows in the table called ‘entries’

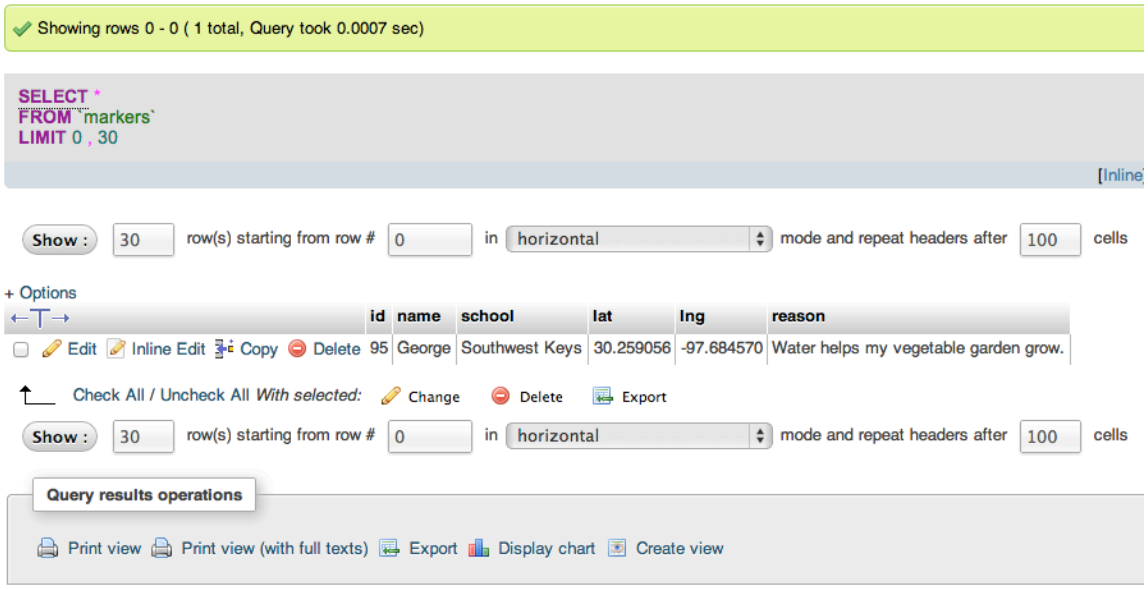


Figure 14: Rows in the table called ‘markers’

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